

Advanced Combustion via Microgravity Experiments (ACME)



Combustion Integrated Rack (CIR)

Spherical Flame (s-Flame)

PI: Prof. C. K. Law, Princeton University

Co-Is: Prof. Stephen Tse, Rutgers U.; Dr. Kurt Sacksteder, NASA GRC

Flame Design

PI: Prof. Richard Axelbaum, Washington University, St. Louis

Co-Is: Prof. Beei-Huan Chao, U. Hawaii; Prof. Peter Sunderland, U. Maryland; Dr. David Urban, NASA GRC

Coflow Laminar Diffusion Flame (CLD Flame)

PI: Prof. Marshall Long, Yale University

Co-I: Prof. Mitchell Smooke, Yale University

Electric-Field Effects on Laminar Diffusion Flames (E-FIELD Flames)

PI: Prof. Derek Dunn-Rankin, UC Irvine

Co-Is: Prof. Felix Weinberg, Imperial College, London; Dr. Zeng-Guang Yuan, NCSER/GRC

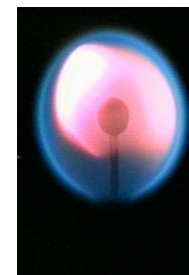
PS's: Dennis Stocker, NASA GRC; Dr. Fumiaki Takahashi, NCSER/GRC

PM: Robert Hawersaat, NASA GRC

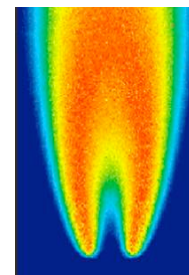
Engineering Team: ZIN Technologies, Inc.



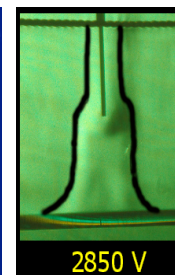
s-Flame
(drop test)



Flame
Design
(drop test)



CLD Flame
(aircraft test)



E-FIELD
Flames
(1g schlieren)

Glenn Research Center

Objective:

- ♦ Modular apparatus designed for gaseous fuel investigations to study:
 - combustion structure and stability near flammability limits
 - soot inception, surface growth, and oxidation processes
 - emission reduction through nitrogen exchange
 - combustion stability enhancements via an electric field

Relevance/Impact:

- ♦ Verified computational models that will enable the design of high efficiency, low emission combustors operating at near-limit conditions.
- ♦ Reduced design costs due to improved capabilities to numerically simulate combustion processes.
- ♦ Efficient soot control strategies for industrial applications.

Development Approach:

- ♦ The ACME flight design leverages off the MDCA flight design.
- ♦ Multi-user, re-usable apparatus minimizing up-mass/volume, costs, and crew involvement.
- ♦ The ACME fuel dilutions are ethylene/nitrogen, methane/nitrogen and methane/hydrogen.

Revision Date: 10/16/2009

Project Life Cycle Schedule

Milestones	SCR	RDR	PDR	CDR	Safety (PH-3)	SAR (PSR)	FHA	Launch	Ops	Return	Final Report
Actual/ Baseline	2/2008	3/2010	9/2010	11/2011	12/2012	1/2013	1/2013	TBD	TBD	TBD	TBD
Documentation	Website: spaceflight systems.grc.nasa.gov/Advanced/ISSResearch/Investigations/ACME eRoom: collaboration.grc.nasa.gov/eRoom/NASAc1f1/GaseousCombustion/0_56f47				SRD: in work EDMP:			Project Plan: in work SEMP: in work			

ISS Resource Requirements

Accommodation (carrier)	CIR
Upmass (kg) (w/o packing factor)	250 kg
Volume (m³) (w/o packing factor)	0.50 m ³
Power (kw) (peak)	0.75 Kw
Crew Time (hrs) - Initial configuration of CIR Rack - Change-outs during experiment	8 hrs 8 hrs
Autonomous Ops (hrs)	200 hrs
Launch/Increment	TBD